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Abstract

We show that a market access requirement (MAR) can increase competition and reduce prices if a properly designed subsidy scheme is used to enforce the requirement. This is in contrast to most of the recent literature which has generally concluded that MARs are unambiguously anticompetitive. Our analysis underscores the importance of proper targeting and shows that it is sensitive to the composition of firms within an industry.

JEL Classification Number: F13

Key words: contingent subsidies, market access requirements, results oriented policies

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1 Introduction

Strongly debated for over a decade, results-oriented trade policies such as export targets or market access requirements (MARs) continue to be viewed with skepticism. Verdier's (1998) recent survey of results-oriented versus rules-oriented policies paints a clear picture as to why. Despite their apparent political popularity and use in Japanese-US trade relations, the academic literature is primarily negative, either showing MARs to be anticompetitive or that, given a choice, the importing country government would prefer a rules-oriented policy because of verification aspects of a MAR.¹ Two exceptions, Krishna and Morgan (1998) and Krishna *et al* (1997) show that MARs in intermediate goods markets can be procompetitive when related final goods markets are considered. Krishna and Morgan (1998) consider an imperfectly competitive model in which the MAR is enforced by the threat of a tariff in the final goods market, while Krishna *et al* (1997) consider perfectly competitive markets where a MAR on the intermediate good is shown to lower marginal cost in the final goods market. In this paper, we examine the possibility of procompetitive MARs in the absence of related market effects.

We focus on a MAR in which an importing country, say, Japan, 'voluntarily' agrees to guarantee a certain minimum share of its home market for a final good exported from a particular country, say, the US, and we show that such a MAR can increase competition and reduce prices if a properly designed contingent subsidy scheme is used to enforce the requirement. While there are a number of other instruments that could be used (and were by the Japanese authorities in the Semiconductor Agreement), we consider subsidies because they are feasible in a wide range of environments where direct control is not.² Additionally, we focus on the least cost subsidies that enforce the MAR.

Formally, in a one-period Cournot model with multiple Japanese and US firms, we analyze a subsidy scheme in which each targeted firm receives a monetary reward proportional to its individual share of the market if the

¹See, for example, Krishna *et al* (1998), Verdier (1997), Greaney (1996), Greaney (1997), Ethier and Horn (1996), Cronshaw and Markusen (1995), Dumler (1996), Irwin (1994), among others.

²As noted by Greaney (1996), the Japanese government had no legal authority to restrict Japanese sales, so that MITI had to rely on "moral suasion" or the use of financial instruments to provide incentives for firms to meet the target.

market access requirement is met.³ Three different targeting schemes are considered: (i) contingent subsidies for US firms, (ii) contingent subsidies for Japanese firms, and, (iii) contingent subsidies for both US and Japanese firms. In all three scenarios, the Japanese government moves first in announcing total expenditure for the subsidy scheme. Using numerical calculations, for different industry compositions, we pick the least cost policy that enforces the MAR and determine whether or not aggregate output increases relative to free trade. We show that when the number of US firms is much smaller than the number of Japanese firms, the least cost subsidy – targeting only the US firms – is procompetitive. However, when the number of US firms is much greater than the number of Japanese firms, the least cost subsidy – targeting only the Japanese firms – is anticompetitive. When the US and Japanese industries are of similar size, the least cost subsidy – targeting both US and Japanese firms – is procompetitive if the number of US firms is no smaller than the number of Japanese firms, but is anticompetitive otherwise.

The intuition behind our results is best seen in the case of two firms—one Japanese and one US. A contingent subsidy, offered only to the US firm in the event the market share target is met, creates an incentive for the US firm to expand output. Since the payment is made only after market clearing, the Japanese firm's best response is unchanged. With strategic substitutes and stability, the equilibrium involves higher aggregate output as US output increases and Japanese output decreases less than proportionately. In contrast, if the Japanese firm is targeted, it will decrease output to avail itself of the subsidy, but the US best response is unaffected. In equilibrium, US output increases less than proportionately so that total output falls and price rises. In this simple case, procompetitive targeting involves subsidizing only the US firm. With more firms or other targeting schemes, the analysis is more complicated, but the basic idea is that with a subsidy targeted to the right set of firms the MAR can be met in a procompetitive manner.

These results are in stark contrast to other studies that examine MARs in the context of a single market. Consider, for example, Krishna *et al*

³In general, it is well understood (see Sen, 1966) that share based subsidy schemes are more high powered than specific subsidies. The reason is that raising one's own output not only raises one's own share, but has a negative externality on that obtained by others, *ceteris paribus*. Sen pointed this out in the context of the work points system used in Communist China where workers were awarded work points for their effort and the share of output they obtained was equal to their share of the total work points. In this paper, however, it makes no difference whether the contingent subsidy is share based or specific.

(1998) which also examines the use of subsidies to enforce market access requirements. Key differences in the two approaches are that in the former study (i) subsidies are triggered, not when the MAR is met (as in this paper), but when the market share constraint is violated and (ii) the government moves last so that the level of the subsidy is determined only after firms make their strategic choices, i.e., the subsidy is determined after firms announce their strategic choices but before the market clears. This timing is shown to create powerful incentives for firms to raise prices in the targeted market. The intuition is that the US firm has an incentive to trigger a subsidy for itself by raising price and lowering its sales such that the market share target is violated. On the other hand, the Japanese firm is strategically motivated to increase its price in order to reduce its market share and prevent the subsidy from being conferred on the US product.

Most other analyses of MARs rely on financial penalties to enforce the access requirement. The most straightforward of these is the duopoly model of Greaney (1996) where the Japanese government moves first and threatens its domestic firm with a preannounced harsh financial penalty in the event that the market share target is not met.⁴ In this case, the Japanese firm has a strategic incentive to raise price in order to lower its sales and prevent the penalty from being triggered. The strategic behavior of the US firm is not affected by the penalty threat since the threat is enforced only after the market clears and profits have been earned. However, since the firms are competing in strategic complements, the US firm matches its rival's price increases and, in equilibrium, both prices are higher compared to free trade. By adopting the same timing structure as Greaney (1996), we are able to show that the use of contingent subsidies with proper targeting can, in contrast to the common perception of MARs, be procompetitive.

⁴Her analysis does consider subsidies but as an alternative to a market access requirement or VIE (enforced by a penalty threat). She finds the two instruments have opposite effects on price, with the VIE raising prices. In contrast, Krishna *et al* (1998) emphasize the potential use of a subsidy to enforce a VIE and show that if the subsidy is triggered by a violation of the market share target, firms with market power will have an incentive to raise price. Greaney (1997) focuses on VIEs in the context of a model with buyer switching costs and shows an import subsidy used to offset these switching costs can enhance competition. There are usually several different ways of implementing a MAR and the effects of the requirement depend critically on the details of the enforcement mechanism.

2 Model

We consider m Japanese firms and n US firms competing in quantities in a specific Japanese market. Let Japanese firm i 's output be denoted by x_i and let y_j represent the output of US firm j . We devise a subsidy scheme based on individual market shares in each of three scenarios. In the first, only US firms are targeted for the subsidy while in the second, only Japanese firms are offered the subsidy. Finally, we look at the case where both US and Japanese firms are given the subsidy incentives.

The structure of the game is as follows. In the first stage, the government announces that each targeted firm will receive part of a given subsidy outlay S equal to its individual share of the market only if the aggregate US market share meets the minimum level specified by the MAR. For instance, when only US firms are offered a subsidy if the target is met, US firm j receives $\left(\frac{y_j}{\sum_{j=1}^n y_j}\right) S$ over and above its ordinary profit. The firms then simultaneously and noncooperatively choose outputs in the second stage after which the market clears and the government pays out the pre-announced subsidies only if the market share target is met.

We assume a twice continuously differentiable inverse demand function $P(X)$ that is downward sloping, $P'(\cdot) < 0$, and strictly concave, $P''(\cdot) < 0$, whenever positive. We also assume each firm has a constant marginal cost of production c . We focus on subgame perfect equilibria.

3 Subsidy policy with only US firms targeted

First, we consider a market share subsidy that is offered only to the US firms.

3.1 US firm's best response

Consider US firm k 's optimal choice. Its profit without the subsidy, i.e., its ordinary profit is

$$\pi_k(\cdot) = [P(\sum_{i=1}^m x_i + \sum_{j=1}^n y_j) - c]y_k \quad (1)$$

while its profit with the market share subsidy is

$$\bar{\pi}_k(\cdot) = \pi_k(\cdot) + \left(\frac{y_k}{\sum_{j=1}^n y_j} \right) S \quad (2)$$

Clearly, $\bar{\pi}_k(\cdot)$ lies everywhere above $\pi_k(\cdot)$. It can be verified that $\bar{\pi}_k(\cdot)$ is concave and, for $n \geq 2$, has a maximizer $\bar{B}_k(\cdot)$ that is greater than $B_k(\cdot)$, the maximizer of $\pi_k(\cdot)$.⁵

Now, consider the constraint that must be met in order for firm k to receive the subsidy, namely,

$$\frac{\sum_{j=1}^n y_j}{\sum_{i=1}^m x_i + \sum_{j=1}^n y_j} \geq \alpha \quad (3)$$

Rearranging, we see that firm k gets the subsidy only if $y_k \geq \frac{\alpha}{1-\alpha} \sum_{i=1}^m x_i - \sum_{j \neq k} y_j$. Denote $g_k(\cdot)$ as the minimum amount that firm k has to produce to trigger the subsidy, i.e.,

$$g_k(\cdot) \equiv \frac{\alpha}{1-\alpha} \sum_{i=1}^m x_i - \sum_{j \neq k} y_j \quad (4)$$

Then, k 's overall profit function is given by

$$\hat{\pi}_k(\cdot) = \begin{cases} \pi_k(\cdot) & \text{for } y_k < g_k(\cdot) \\ \bar{\pi}_k(\cdot) & \text{for } y_k \geq g_k(\cdot) \end{cases} \quad (5)$$

Depending on rival outputs, three possible cases, as depicted in Figures 1(a), 1(b) and 1(c), respectively, may arise. The overall profit function is depicted by the bold curve in all three figures. Let $\hat{B}_k(\cdot)$ denote firm k 's overall best response. In the first case, the output that maximizes $\bar{\pi}_k(\cdot)$ exceeds the minimum output needed to meet the constraint ($g_k(\cdot) \leq \bar{B}_k(\cdot)$) and, clearly, firm k is best off choosing $\hat{B}_k(\cdot) = \bar{B}_k(\cdot)$. In the second case, $g_k(\cdot) > \bar{B}_k(\cdot)$ and it is optimal to produce just enough so as to satisfy the market share target and earn a subsidy, i.e., $\hat{B}_k(\cdot) = g_k(\cdot)$ is optimal. Finally, we may have the situation depicted in the third case where the US firm is best off ignoring the temptation of the subsidy and producing along its ordinary best response, i.e., $\hat{B}_k(\cdot) = B_k(\cdot)$.

⁵When $n = 1$, $\bar{\pi}_k(\cdot) = \pi_k(\cdot) + S$ and the maximizer of the US firm's profit with subsidy is identical its ordinary profit maximizer, i.e., $\bar{B}_k(\cdot) = B_k(\cdot)$.

The nature of a US firm's best response can be better grasped by considering the duopoly case (i.e., $m = 1, n = 1$) as depicted in Figure 2. $B_1(\cdot)$ and $B_2(\cdot)$ are the Japanese and US firms' ordinary Cournot best responses, respectively, while $\bar{B}_2(\cdot)$ depicts the maximizer of the US firm's profit with the subsidy. The market share constraint line OM is shown to lie above and to the left of the free trade point F since the constraint is assumed to be binding under free trade. Then, the US firm's overall best response is depicted by the bold curve. For small Japanese outputs, the overall best response lies along $\bar{B}_2(\cdot)$ until the point H where $\bar{B}_2(\cdot)$ intersects the market share line OM . For Japanese outputs greater than this level, the US firm switches to producing along the market share line. This continues until point I is reached, whereupon, the US firm's overall best response jumps down to point J on its ordinary best response. Note that for $x = J_1$, the US firm is indifferent between producing its Cournot output and between producing the minimum output necessary to earn the subsidy. Further, it can be shown that this jump point J_1 , is increasing in S .

It should be noted that, as indicated in footnote 5, unlike the general case, the US firm's profit with the subsidy simply equals its ordinary profit plus a constant S . Thus, for this special case, $\bar{B}_2(\cdot)$, the maximizer of the US firm's profit with the subsidy coincides with $B_2(\cdot)$. However, in general, $\bar{B}_2(\cdot)$ always exceeds $B_2(\cdot)$.

3.2 Equilibrium

As long as only US firms are targeted, the market share subsidy does not affect the Japanese firms strategically and so they continue to produce along their ordinary Cournot best responses. Now, suppose the government picks the smallest S that supports a pure strategy Nash equilibrium satisfying the market share target. Again, referring to the duopoly case for expositional ease, the minimum S is chosen so as to make E_1 in Figure 2 the Japanese output at which the US firm is indifferent between meeting the constraint (by producing at E) and ignoring it (by producing at G on its Cournot best response). Clearly, such an S yields an equilibrium at E that not only satisfies the market access requirement but also yields an aggregate output greater than that under free trade. Hence, implementing a MAR by targeting only

the US firm is procompetitive in the duopoly case.⁶ This result is robust to the number of firms as well as the composition of firms. The intuition for the procompetitive outcome is that the market share subsidy gives an incentive to the US firms to expand their output. This results in a less than proportionate contraction of Japanese output (strategic substitutes) such that aggregate output increases.

4 Subsidy policy with only Japanese firms targeted

Suppose the subsidy incentives were offered to only the Japanese firms.

4.1 Japanese firm's best response

Consider Japanese firm l 's optimal choice. Its ordinary profit is

$$\pi_l(.) = [P(\sum_{i=1}^m x_i + \sum_{j=1}^n y_j) - c]x_l \quad (6)$$

while its profit with the market share subsidy is

$$\bar{\pi}_l(.) = \pi_l(.) + \left(\frac{x_l}{\sum_{i=1}^m x_i} \right) S \quad (7)$$

As before, subsidy-ridden profit $\bar{\pi}_l(.)$ lies everywhere above $\pi_l(.)$, is concave, and, for $m \geq 1$, $\bar{B}_l(.)$ is greater than $B_l(.)$.

Now, consider the constraint that must be met in order for Japanese firm l to receive the subsidy. Firm l gets the subsidy only if $x_l \leq \frac{1-\alpha}{\alpha} \sum_{j=1}^n y_j - \sum_{i \neq l} x_i$. Denote $h_l(.)$ as the maximum amount that firm l can produce and still get the subsidy, i.e.,

$$h_l(.) \equiv \frac{1-\alpha}{\alpha} \sum_{j=1}^n y_j - \sum_{i \neq l} x_i \quad (8)$$

⁶While Figure 2 has been drawn for the case of linear demand, the result holds as long as the slopes of the Cournot best responses lie between -1 and 0 (guaranteed by our assumptions on demand and cost).

Then, for any rival outputs, l 's overall profit function is given by

$$\hat{\pi}_l(.) = \begin{cases} \pi_l(.) & \text{for } x_l > h_l(.) \\ \bar{\pi}_l(.) & \text{for } x_l \leq h_l(.) \end{cases} \quad (9)$$

Again, we have three cases, as depicted in Figures 3(a), 3(b), and 3(c). In the first case $h_l(.) \geq \bar{B}_l(.)$ and clearly $\hat{B}_l(.) = \bar{B}_l(.)$. In the second case, it produces just enough so as to satisfy the VIE target and earn a subsidy while in the third case, the Japanese firm is best off ignoring the subsidy and producing along its ordinary best response, i.e., $\hat{B}_l(.) = B_l(.)$.

As before, for expositional ease, consider the Japanese firm's overall best response in the duopoly case shown in Figure 4. For small US outputs, the Japanese firm produces along its Cournot best response $B_1(.)$ until the point K where it jumps down to producing along the market share line OM . This is optimal up to point N after which the Japanese firm switches to producing the output $\bar{B}_1(.)$ that maximizes its subsidy profit⁷. Note that the Japanese firm is indifferent between producing at L and K when the US firm produces the corresponding output level K_1 .

4.2 Equilibrium

In this case, the US firms' strategic behavior is unaffected by the subsidy. For the duopoly case shown in Figure 4, the smallest S that supports a Nash equilibrium satisfying the MAR is the S that makes the Japanese firm indifferent between points T and R when the US firm produces the corresponding output level T_1 . This subsidy outlay yields an equilibrium at T that is associated with a lower aggregate output and higher price compared to the free trade point F . Hence, implementing a MAR by targeting only the Japanese firm is anticompetitive in the duopoly case. This result can be shown to be robust to the number of firms as well as the composition of firms. Here, the promise of the subsidy provides an incentive for the Japanese firms to cut back on output. This, in turn, is associated with a less than proportionate increase in the output of US firms such that aggregate output decreases and price increases.

⁷Recall that in this special case with only one firm being targeted, $\bar{B}_1(.)$ coincides with $B_1(.)$.

5 Subsidy policy with both US and Japanese firms targeted

Now, we consider the case where both US and Japanese firms are offered subsidy incentives.

5.1 US and Japanese firms' best responses

In this scenario, US firm k 's profit with the market share subsidy is $\bar{\pi}_k(.) = \pi_k(.) + [y_k/(\sum_{i=1}^m x_i + \sum_{j=1}^n y_j)]S$ and the subsidy profit for Japanese firm l is given by $\bar{\pi}_l(.) = \pi_l(.) + [x_l/(\sum_{i=1}^m x_i + \sum_{j=1}^n y_j)]S$. Though these expressions are different from those in the previous two sections, the analysis is analogous and the best responses are qualitatively similar. However, the overall best responses for the duopoly case differ from the previous two targeting regimes since the best response when the subsidy is earned differs from that when it is not earned so that $B \neq \bar{B}$. Figure 5 and Figure 6 show the US and Japanese firm's best responses, respectively, under this policy.

5.2 Equilibrium

For the duopoly case, the smallest S that supports a pure strategy Nash equilibrium satisfying the market share target is given by that S for which the two overall best responses just touch each other along the market share line before jumping to their respective Cournot responses. This is shown in Figure 7 where the equilibrium must lie at some point along the segment HN on the market share line. The analysis is similar to that in Krishna and Morgan (1997) and the interested reader is referred to it for more details. While it is impossible to analytically discern how the equilibrium price compares to the free trade price, numerical calculations show that aggregate output increases when the number of US firms is no less than the number of Japanese firms. The intuition is that this policy scheme creates strategic incentives for the US firms to expand output and for the Japanese firms to reduce output. However, with more US firms relative to Japanese firms, the expansion of US output outweighs the contraction in Japanese output such that prices fall. Now, we turn to a comparison of the different policies – the subject of the next section.

6 Comparison of the subsidy policies

Due to tractability problems, we have to rely on numerical simulations for a comparison of the different targeting schemes. To this end, we consider an industry comprised of m Japanese firms and n US firms under the restriction that $m \leq 10; n \leq 10$. We assume a linear inverse demand $P = 10 - (\sum_{i=1}^m x_i + \sum_{j=1}^n y_j)$ and zero marginal costs of production. The market access requirement is set at a level 10% greater than the aggregate US market share under free trade. For any given industry configuration, we compute the subsidy outlay S required to meet the MAR under each of the three subsidy policies, and, pick the policy that entails the least subsidy expenditure. Then, we examine whether or not the least cost subsidy increases aggregate output relative to free trade. The results of the simulations are presented in Figure 8 and Figure 9.

We find that when there are relatively many US firms, then subsidizing only Japanese firms is the cheapest way to implement the policy and, as expected, the policy is anticompetitive as the reductions in Japanese output are less than compensated for by the increases in US output. Why is it cheapest to subsidize the Japanese firms in this case? Think of the case where there are 10 firms in total, nine of which are US firms. In order to raise their market share by 10%, assuming the output of the Japanese firm is fixed, each of the nine US firms must increase its output by about .1 units. But the market share can be met by having the Japanese firm reduce its output by about the same .1 unit! It is likely to be cheaper to influence the one Japanese firm than all nine US firms!

When there are relatively many Japanese firms, then for analogous reasons, subsidizing only US firms is the cheapest way to implement the policy and, as expected, the policy is procompetitive. When there are relatively similar numbers of US and Japanese firms, then subsidizing both is the cheapest way to implement the policy. In this case, the numbers advantage outlined above is limited and raising US output a bit as well as reducing Japanese output a bit is more effective than just doing either. Also, as expected, the policy is anticompetitive if there are more Japanese firms than US ones and procompetitive if there are more US firms than Japanese.

7 Conclusion

We show that, contrary to the recent literature, market access requirements can be implemented in a procompetitive manner if they are properly enforced. If the least cost policy is to subsidize only Japanese firms, then in order to meet the market share target

$$\frac{\sum_{j=1}^n y_j}{\sum_{i=1}^m x_i + \sum_{j=1}^n y_j} \geq \alpha \quad (10)$$

aggregate Japanese output, $\sum_{i=1}^m x_i$, must decrease. The direct effect of the reduction in Japanese output outweighs the indirect effect of the corresponding increase in aggregate US output causing the subsidy to be anti-competitive. By similar reasoning, if the least cost policy is to subsidize only US firms aggregate output will increase relative to free trade output and the subsidy will be procompetitive. When the least cost policy is to subsidize both US and Japanese firms then the subsidy is procompetitive if the number of US firms is no smaller than the number of Japanese firms, but is anticompetitive otherwise.

Our contribution, therefore, is to show that MARs can be procompetitive even in the absence of threats in related markets. By focusing on subsidies that are paid only when the market share target is met, we have shown a MAR can increase aggregate output relative to free trade provided that the right set of firms is targeted. Of course, proper targeting is sensitive to the firm-composition of the industry, bolstering the point emphasized earlier (see Krishna *et al*, 1998) that the effects of a MAR depend critically on the way in which it is implemented.

Finally, while our results for more than two firms are based on numerical calculations and may not generalize, the results for two firms are robust to different functional forms or market share targets as long as stability conditions are met. The duopoly results are also robust to the type of competition, i.e., the contingent subsidy can be shown to lower prices of both goods under Bertrand competition in a differentiated products duopoly.

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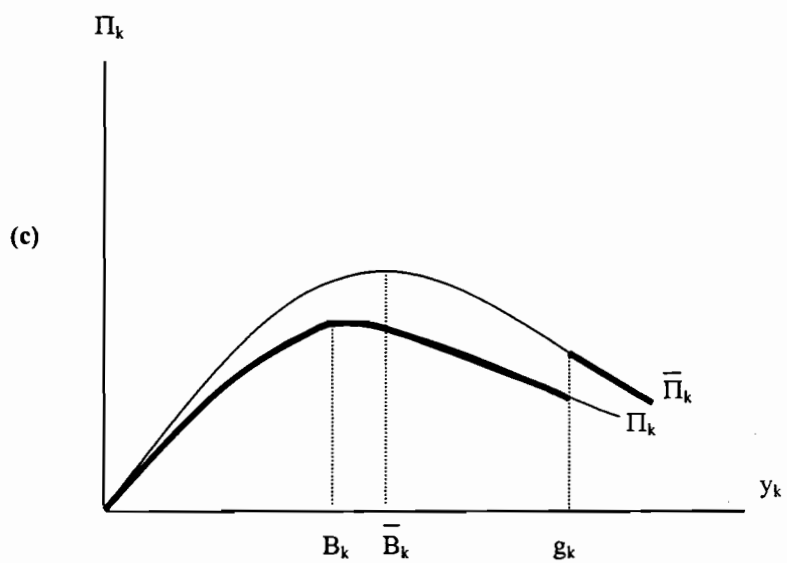
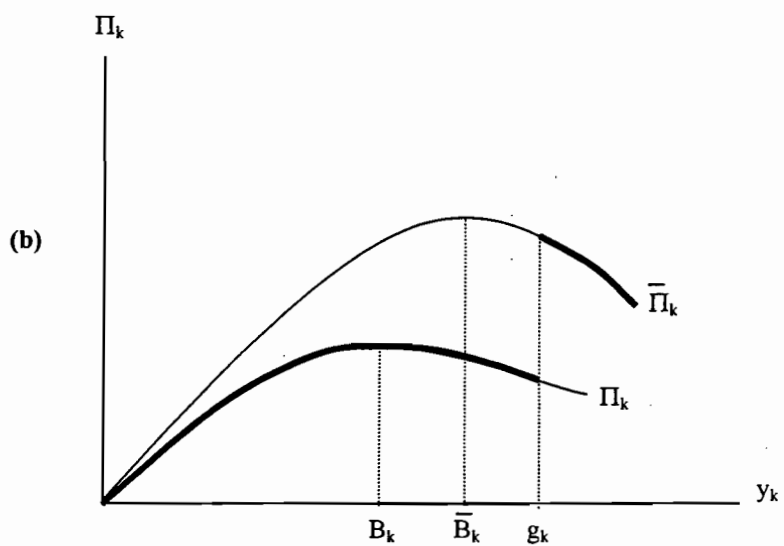
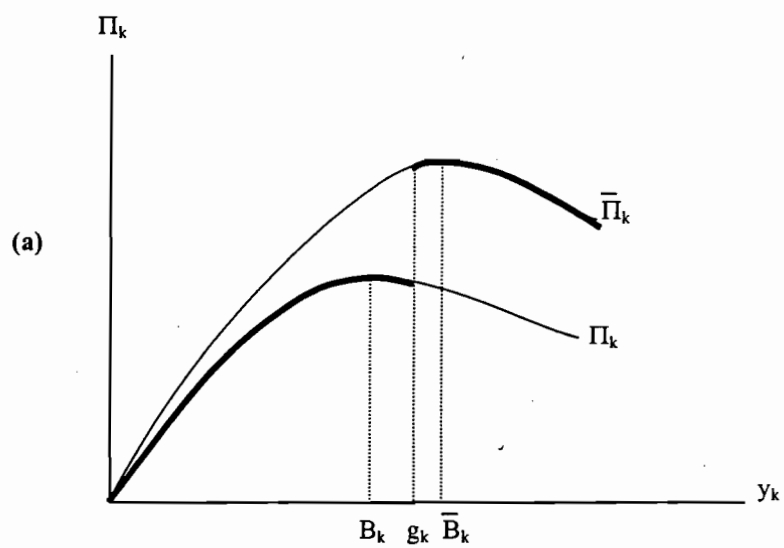


Figure 1. US firm's overall profit functions (shown in bold).

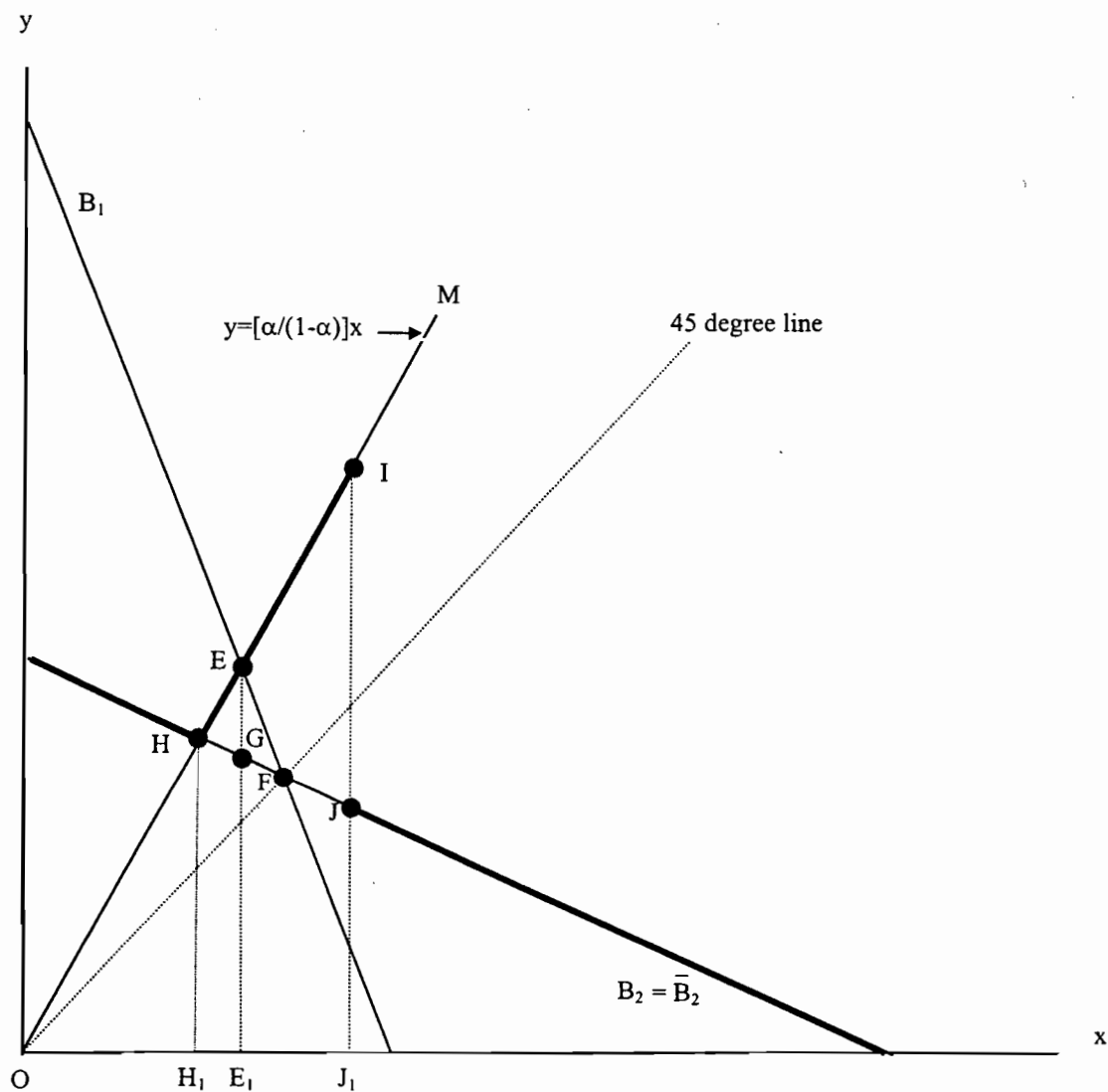


Figure 2. US firm's overall best response (shown in bold) when only it is targeted for a market share subsidy.

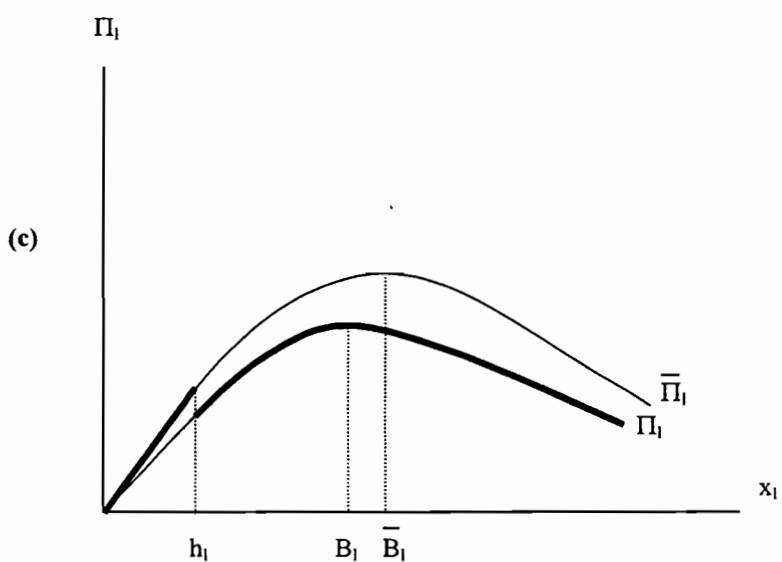
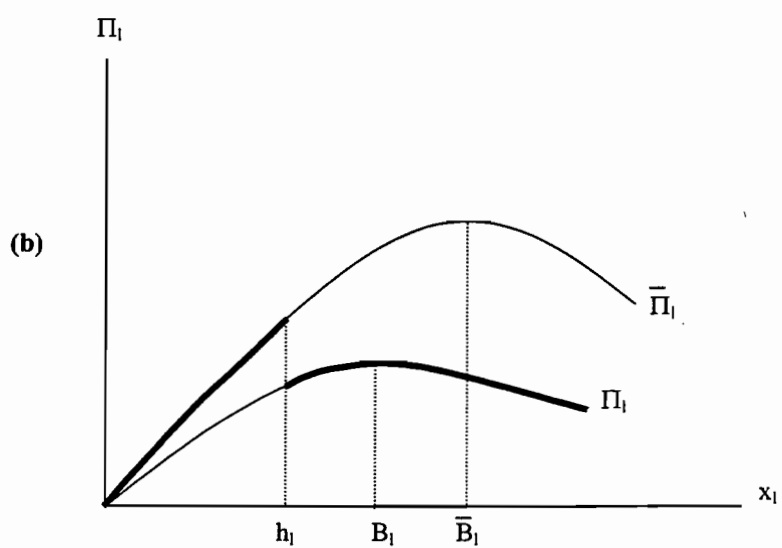
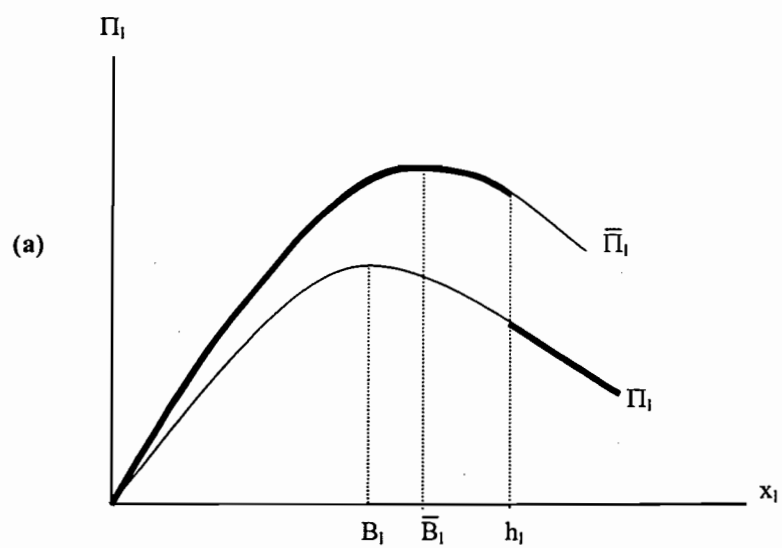


Figure 3. Japanese firm's overall profit functions (shown in bold).

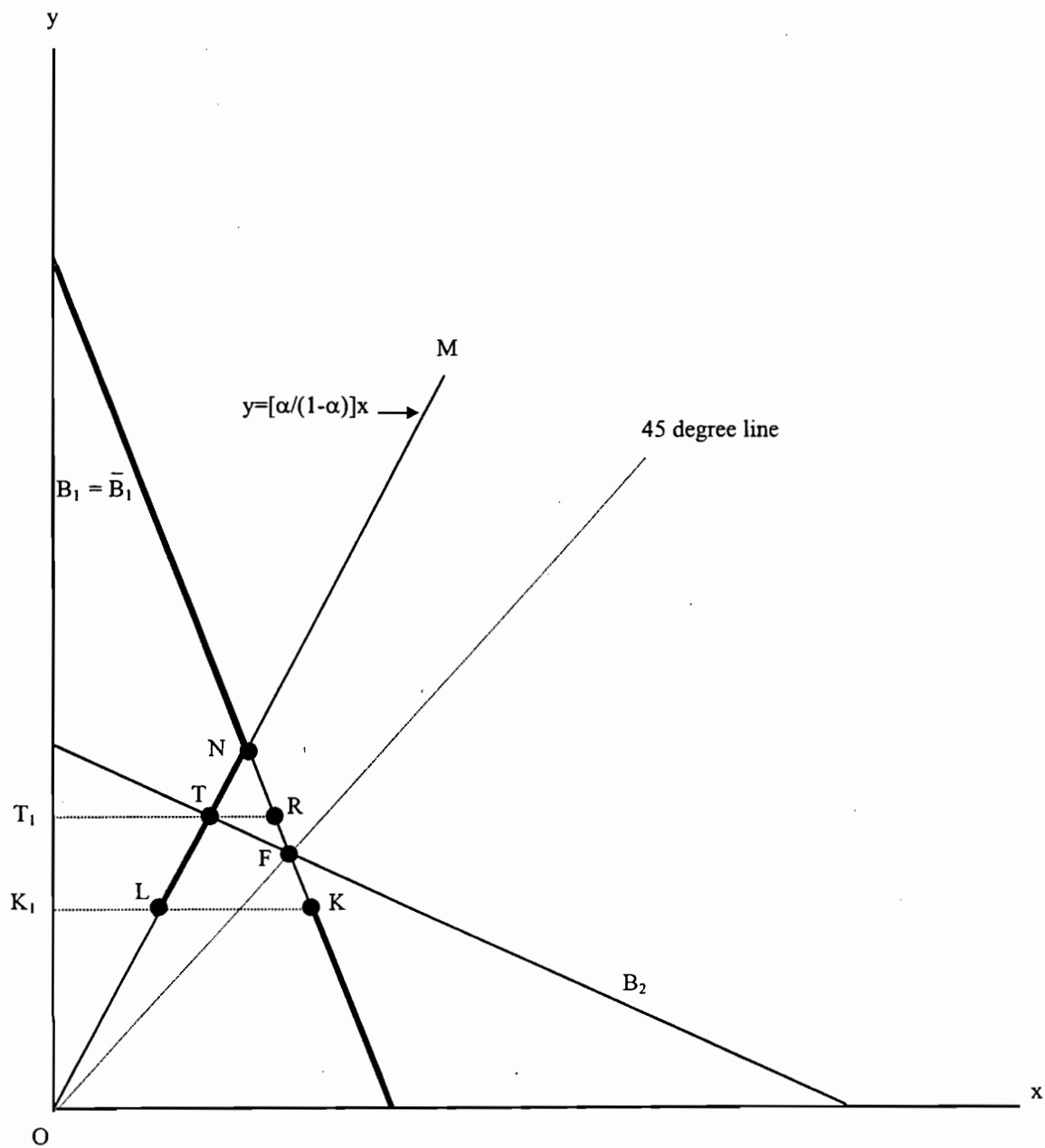


Figure 4. Japanese firm's overall best response (shown in bold) when only it is targeted for a market share subsidy

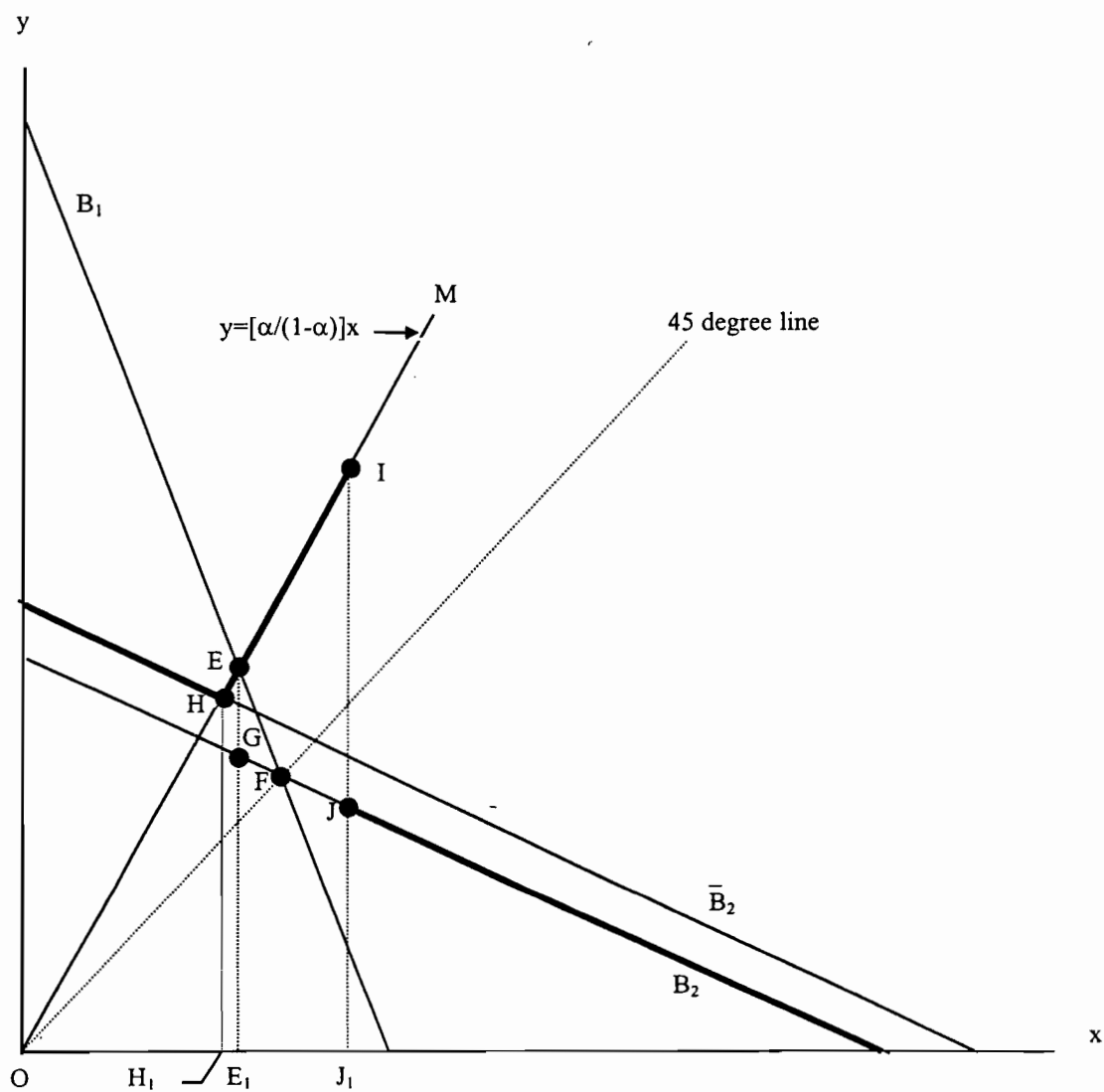


Figure 5. US firm's overall best response (shown in bold) when both firms are targeted for a market share subsidy.

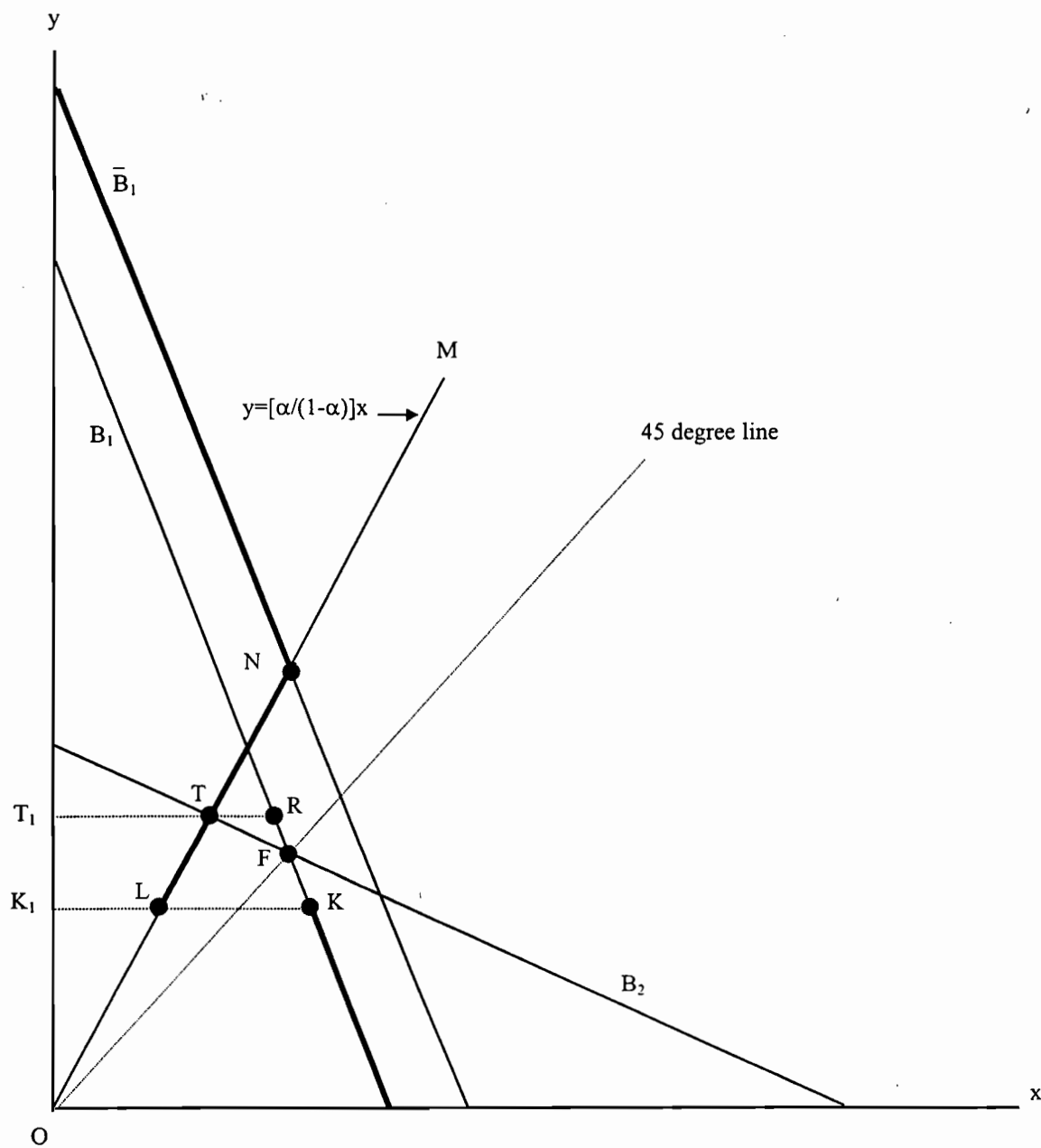


Figure 6. Japanese firm's overall best response (shown in bold) when both firms are targeted for a market share subsidy.

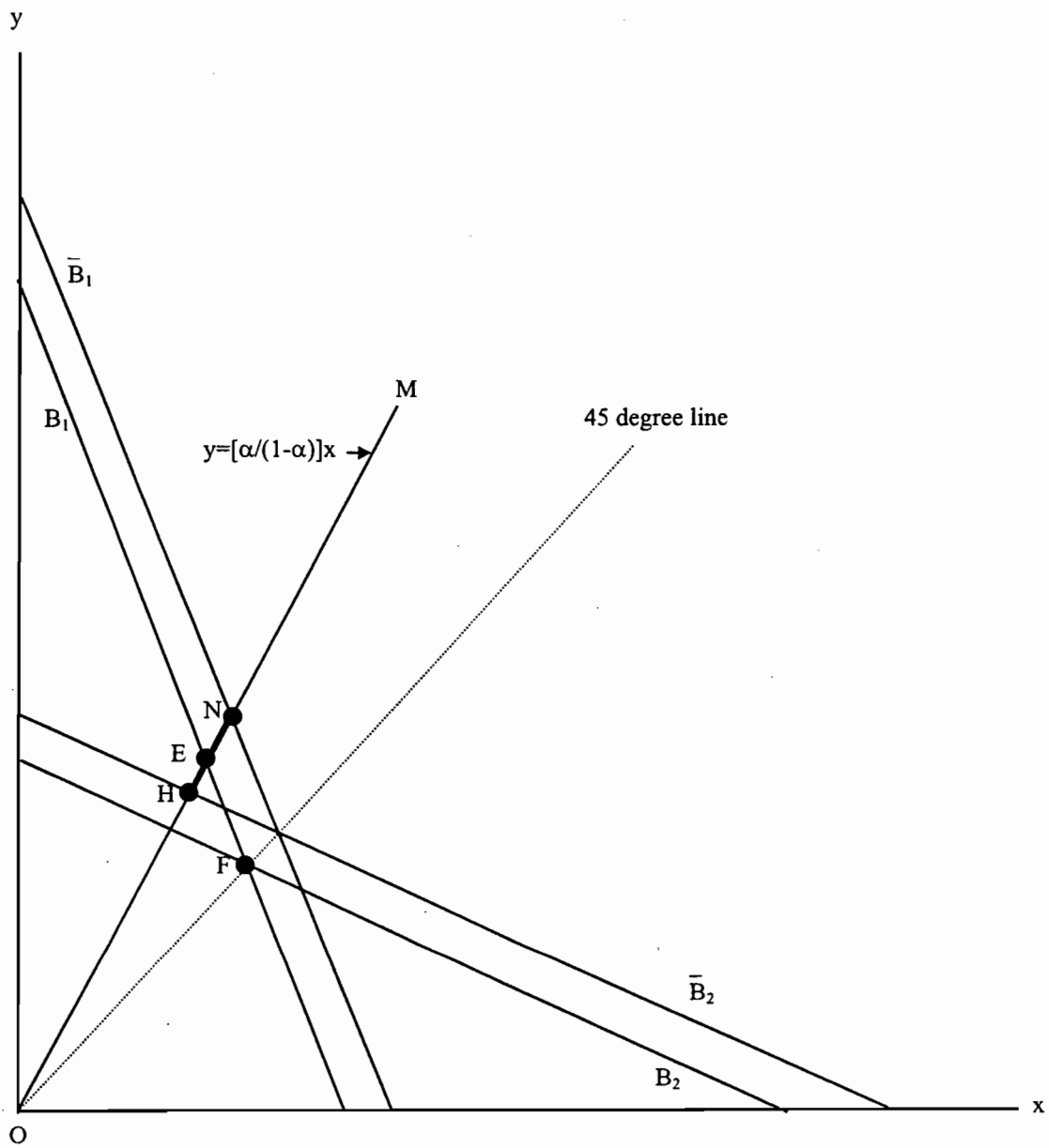
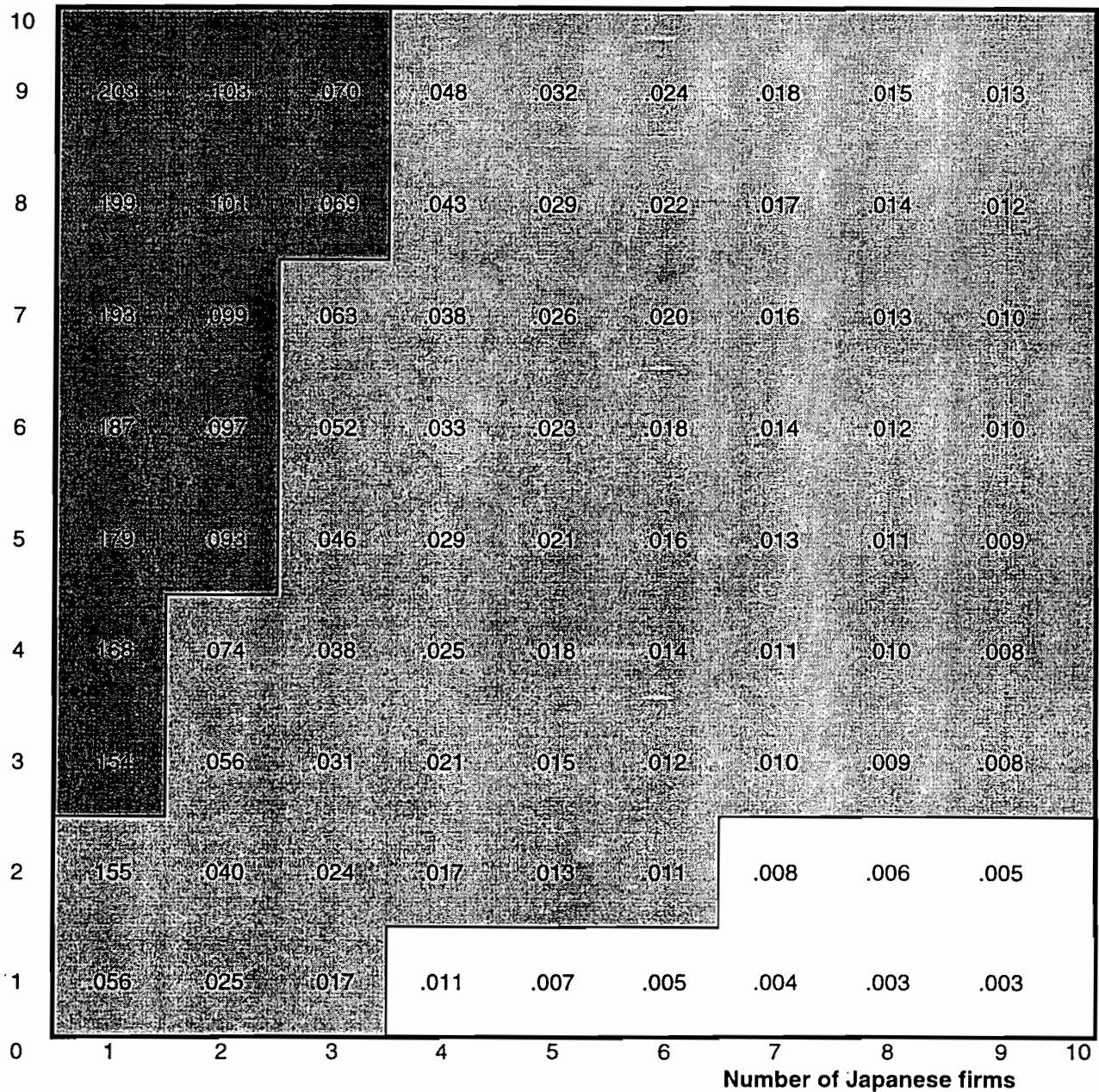


Figure 7. Equilibria when both US and Japanese firms are targeted for subsidies.

Number of US firms



Key




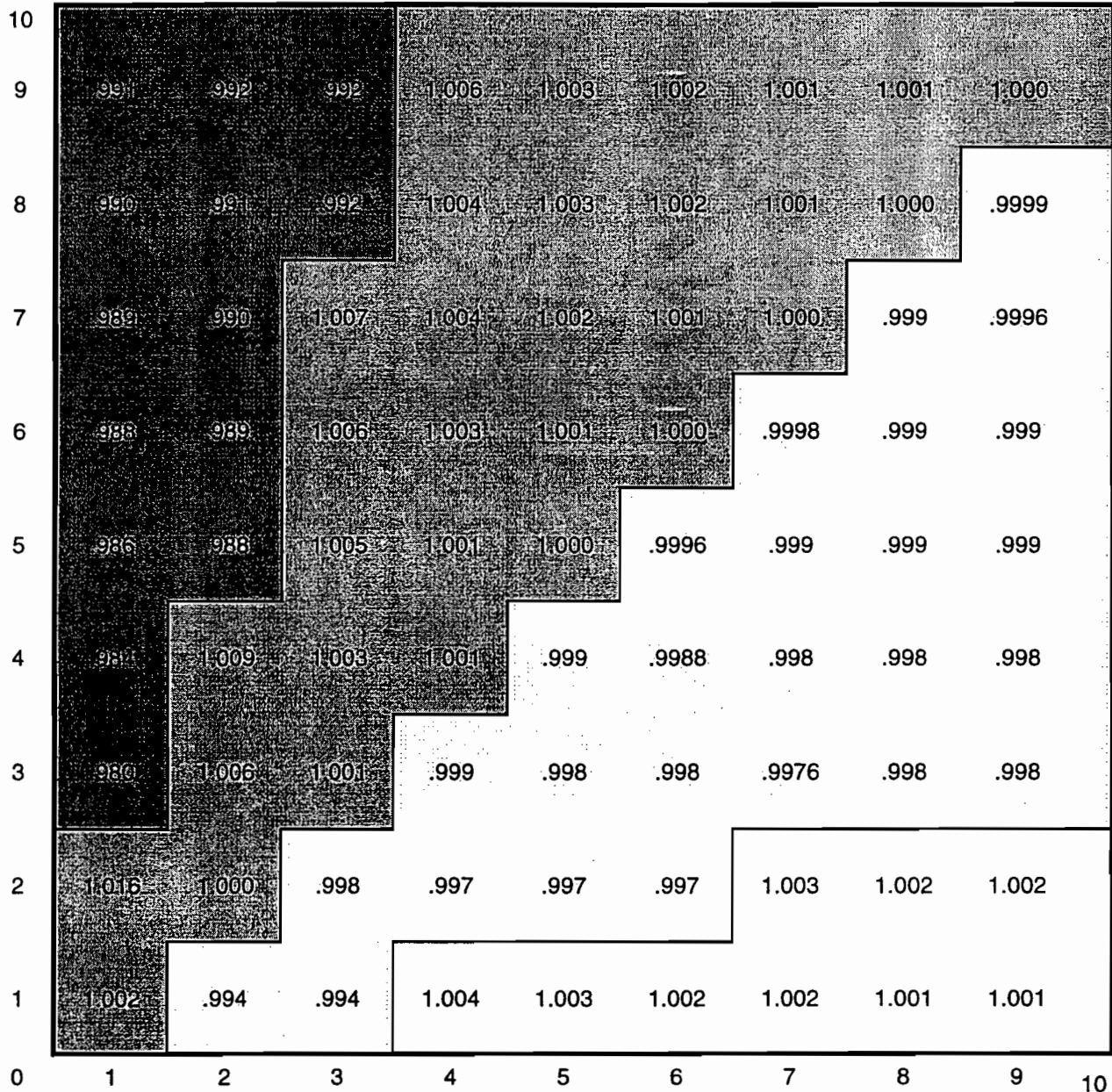
-  Subsidizing the Japanese firms only is the cheapest way to meet the market share target.
-  Subsidizing both Japanese and U.S. firms is the cheapest way to meet the market share target.
-  Subsidizing the U.S. firms only is the cheapest way to meet the market share target.

Figure 8. Minimum subsidy expenditure over different regimes.

Number of US firms



Number of Japanese firms

Key





-  Cheapest subsidy (only Japanese firms subsidized) is anticompetitive.
-  Cheapest subsidy (both Japanese and U.S. firms subsidized) is procompetitive.
-  Cheapest subsidy (both Japanese and U.S. firms subsidized) is anticompetitive.
-  Cheapest subsidy (only U.S. firms subsidized) is procompetitive.

Figure 9. Aggregate output (with the cheapest subsidy) as a proportion of the free trade output.

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